



SLOVENSKI STANDARD

SIST ISO 4407:1997

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Fluidna tehnika - Hidravlika - Onesnaženje fluidov - Ugotavljanje onesnaženosti z delci - Metoda štetja z mikroskopom

Hydraulic fluid power -- Fluid contamination -- Determination of particulate contamination by the counting method using a microscope

iTeh STANDARD PREVIEW

Transmissions hydrauliques -- Pollution des fluides -- Détermination de la pollution particulaire solide -- Méthode de comptage au microscope

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Ta slovenski standard je istoveten z: **ISO 4407:1991**

ICS:

23.100.60	Filtri, tesnila in onesnaževanje tekočin	Filters, seals and contamination of fluids
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INTERNATIONAL STANDARD

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Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using a microscope

iTeh STANDARD PREVIEW

(Standard by iTeh)
*Transmissions hydrauliques — Pollution des fluides — Détermination de
la pollution particulaire solide — Méthode de comptage au microscope*

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Reference number
ISO 4407:1991(E)

ISO 4407:1991(E)**Foreword**

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4407 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*.

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Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. The liquid is both a lubricant and power-transmitting medium.

Reliable system performance requires control of the fluid medium. Qualitative and quantitative determination of particulate contamination in the fluid medium requires precision in obtaining the sample and determining the nature and extent of contamination.

The microscope method of determining fluid contamination involves counting illuminated filtered particles under a microscope. The method employs membrane filters, which maintain fluid cleanliness by removing insoluble particles.

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Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using a microscope

1 Scope

This International Standard defines methods of determining the solid particle contamination of hydraulic fluids used in hydraulic fluid power systems by counting the number of particles on the surface of a membrane filter using a microscope under transmitted light and under incident light.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4021:1977, *Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system*.

ISO 5598:1985, *Fluid power systems and components — Vocabulary*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5598 and the following definitions apply.

3.1 blank count: Count resulting from contaminants introduced from other sources, such as reagents or cleaning of glassware, which do not exceed 1 000 particles, the size of which are 5 µm or greater.

NOTE 1 For this determination, a clean, unused membrane is prepared as indicated in clause 9, replacing the

sample fluid by the same volume of filtered solvent. Counts in excess of 1 000 particles indicate unsatisfactory test conditions; the required standard should be achieved before sample analysis is undertaken.

3.2 calculation factor: Ratio of the effective area to the total area counted.

3.3 effective area: Area of the membrane open to flow during filtration of the fluid. (This is generally accepted as 100 grid squares and has an area of 890 mm².)

3.4 fibre: Particle longer than 100 µm with a length-to-width ratio greater than, or equal to, 10:1.

3.5 fixative fluid: Fluid which, as a result of a heat-curing process, causes a contaminated membrane filter to adhere to a glass base slide, resulting in an opaque honeycomb residue.

3.6 grid square: Square that has sides of 3,08 mm and is printed on the membrane filter.

3.7 mountant fluid: Fluid which is applied to the dry honeycomb residue on the glass base slide to render it transparent.

3.8 particle size: Size of particle determined by measurement using a calibrated ocular micrometer.

3.9 sub-unit area: Area approximately one-twentieth of a grid square used where populations of 25 000 and above are estimated at ×10 magnification. (See 10.2.)

3.10 unit area: Area bounded in the horizontal plane by two adjacent vertical membrane grid lines and in the vertical plane by two parallel lines in the circular micrometer eyepiece or drawn on the projection screen. The dimensions of the unit area are measured by a previously calibrated ocular micrometer.

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4 Counting principle

Filtration of a known volume of hydraulic fluid through a membrane filter under vacuum conditions to collect contaminants on a filter surface. Examination of the membrane microscopically by incident light or, having made it transparent, by transmitted light, to measure, count and size the contaminant particles according to their largest dimension.

5 Apparatus

5.1 Filter holder, comprising

- a graduated glass measuring funnel, of 250 ml capacity;
- a clamping device;
- a suitable base to support the membrane.

5.2 Cap for the funnel

5.3 Filter membrane, 47 mm in diameter, white, gridded, with less than 1 μm pore diameter, each grid square having sides of 3,08 mm and equal to one-hundredth of the effective area of the membrane.

NOTE 2 If the selected method of rendering the membrane transparent implied chemical filter destruction, the membrane filter should have the same characteristics but should not be gridded.

5.4 Vacuum flask, 1 litre capacity.

5.5 Device, capable of establishing a vacuum of 86,6 kPa (0,866 bar)¹⁾ (i.e. 650 mmHg).

5.6 Filtered-solvent dispenser, (i.e. a pressure-operated system which discharges the solvent through a filter membrane, the pore diameter of which is less than or equal to 1,2 μm).

5.7 Flat-ended tweezers, of stainless steel.

5.8 Microscope glass base slides and microscope glass cover slips, thickness 0,25 mm, (for transmitted-light method only).

5.9 Petri dishes, plastic or equivalent, for 47 mm membrane filters (for incident-light method only).

5.10 Drying oven, with temperature control up to 70 °C.

5.11 Microscope, with ocular micrometer eyepiece capable of resolving particles down to 5 μm , fitted with a mechanical stage so that the effective area can be scanned. The nominal magnifications and optical combinations given in table 1 or table 2 are recommended. The optimum equipment is a projector microscope with suitable screen, over-eyepiece mirror and rotating superstage.

Table 1 — Nominal magnifications and optical combinations for transmitted-light method

Magnification		Ocular	Objective
nom.	tol.		
×100	± 10	×10	×10
×200	± 20	×10	×20
×450	± 50	×10	×45

Table 2 — Nominal magnifications and optical combinations for incident-light method

Magnification		Ocular	Objective
nom.	tol.		
×50	± 10	×10	×5 ± 1
×100	± 10	×10	×10 ± 1
×200	± 20	×10	×20 ± 2

5.12 Stage micrometer, graduated in 0,1 mm and 0,01 mm divisions.

5.13 External lamp, of variable intensity, if the microscope does not include any light source through the lenses (for incident-light method only).

5.14 Lamp, suitable to be used as a light source (for transmitted-light method only).

5.15 Tally counter

5.16 Sample bottles, recommended capacity 250 ml, preferably wide-mouthed with a screw cap.

5.17 Sample bottles, at least 100 ml capacity, permanently marked to indicate 100 ml sample size, with screw caps.

1) 1 bar = 10⁵ Pa

5.18 Plastic films, 0,05 mm thick × 50 mm × 50 mm, to be placed between the cap and the neck of the sample bottles.

6 Reagents

6.1 Rinsing and cleaning chemicals

6.1.1 Liquid detergent, without solid residue.

6.1.2 Distilled or demineralized water.

6.1.3 Isopropyl alcohol, acetone free.

6.1.4 Petroleum ether (boiling point 100 °C to 120 °C) or **trichlorotrifluoroethane** (F.113) .

WARNING — Exercise care when using solvents which have low flash points. Appropriate precautions should also be taken to avoid inhalation of toxic fumes emanating from these solvents.

6.2 Fluids for the sampling procedure (for the transmitted-light method)

6.2.1 Fixative fluid (see 3.5).

6.2.2 Mountant fluid, having a refractive index similar to that of the glass cover slip (see 3.7).

7 Glassware cleaning procedure

Clean the filtration apparatus (5.1), bottles (5.16), glass slides and cover slips (5.8) and Petri dishes (5.9) as follows:

- wash the glassware in warm tap water/liquid detergent (6.1.1) solution;
- rinse three times with distilled or demineralized water (6.1.2);
- rinse three times with filtered isopropyl alcohol (6.1.3) to remove water;
- rinse three times with filtered trichlorotrifluoroethane or petroleum ether (6.1.4) (check that petroleum ether does not leave greasy traces), and
 - for the filtration apparatus, turn the funnel upside down for 15 s to allow the solvent to drain and evaporate;
 - for the bottles, leave a little solvent in the bottle and cover by inserting a plastic film (5.18) (rinsed with the filtered solvent) between the neck and stopper.

NOTE 3 Solvent evaporation slightly pressurizes the bottle and therefore precludes contamination when the bottle is opened.

8 Sampling

Extract the sample fluid in accordance with the method laid down in ISO 4021.

9 Procedure

Carry out the following test procedure in a clean room or cabinet.

9.1 Preparation

9.1.1 Using clean tweezers (5.7), remove a membrane filter (5.3) from its container and place it centrally on the screen of the funnel support assembly (5.1). Carefully install and clamp the funnel in position. Do not remove the cap (5.2) from the funnel opening until ready to start filtration.

9.1.2 After noting any details, remove any tied-up or loosely attached labels, ensuring that sample identity is retained.

9.1.3 Thoroughly clean the outside of the sample bottle in the region of the cap by washing with filtered petroleum ether or approved alternative. Shake the bottle vigorously for at least 1 min. Remove cap and film, if fitted, and rinse off any matter adhering to the bottle neck threads with a jet of filtered petroleum ether or approved solvent, ensuring that none of the washings enters the bottle.

9.1.4 Connect the vacuum device (5.5) to the side arm of the vacuum flask (5.4). Pour 100 ml from the sample bottle into the filter funnel. Apply vacuum. When the funnel contents have been reduced to a small volume, rinse down the funnel walls with a spirally directed jet of filtered solvent, taking care not to disturb the particulate matter on the membrane filter. Aspirate to dryness and prepare the membranes following the chosen method of observation (9.2 or 9.3).

9.2 Observation under transmitted light

9.2.1 Take a glass base slide and apply sufficient fixative fluid (6.2.1) onto it.

9.2.2 Using the tweezers, carefully remove the contaminated membrane filter and place it with the contaminated surface uppermost onto the fixative fluid on the glass base slide, aligning the grid on the membrane filter parallel with the edge of the slide.